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Cluster shape analysis and impact on data readout of beam-induced background for 10 TeV Muon Collider

The muon collider stands as one of the most promising prospects for next-generation high-energy particle physics experiments. However, it presents significant challenges, particularly in managing the beam-induced background (BIB) resulting from various muon decay sources. Currently, several mitigation strategies are under investigation, such as leveraging timing information from the innermost tracker detector to improve the tracking performance. On top of that, we are also employing dedicated quality criteria on the tracks itself to filter out some of the in-time BIB from physics collision events.

In this poster, we will demonstrate further reductions in BIB by utilizing the properties of hit clusters produced through realistic event digitization. This will include not only the angular distribution of the clusters, but also the distribution of hits per cluster along with the possibility of overlap removal from multiple incident particles. Additionally, we will explore preliminary estimates of the data readout bandwidth requirements based on hit occupancy, assuming effective control over BIB events.

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